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## Superconducting Curved Canted-Cosine-Theta (CCT) Nested and Combined Error Free Dipole Quadrupole Fields Coil Geometry for the HIE-ISOLDE Recoil Separator Ring Project.

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The ISOLDE facility at CERN delivers the largest range of low-energy radioactive beams, exploited by several detector systems to investigate nuclear properties from the stable isotopes to the very exotic systems close to the neutron or proton drip lines. These studies can largely benefit from the use of a high-resolution fragment separator. To achieve this goal, an innovative spectrometer based on a compact superconducting (SC) ring, the Isolde Superconducting Recoil Separator (ISRS), is being studied. The ring will operate as an isochronous non-scaling fixed-field alternating-gradient (FFAG) system based on Canted-Cosine-Theta (CCT) magnets. These multifunction magnets have two alternating-gradient quadrupoles nested inside an outer dipole. According to preliminary beam dynamics studies, the dipole must sustain a maximum field of 2.2 T. A maximum quadrupole gradient of approximately 14 T/m will guarantee orbit stability for heavy ions with a maximum kinetic energy of 10 MeV/u. Fine tuning of the CCT magnets and the FFAG optics will provide very large solid angles  $> 100$  msr and momentum acceptances  $\Delta p/p > 20\%$ .

In this paper we present, the magnet designs and their optimisation.

A cost reducing active stray field superconducting coil shield design has been introduced to be able to remove approximate 4000 kg of yoke iron and the complexity of building a tightly curved yoke.

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